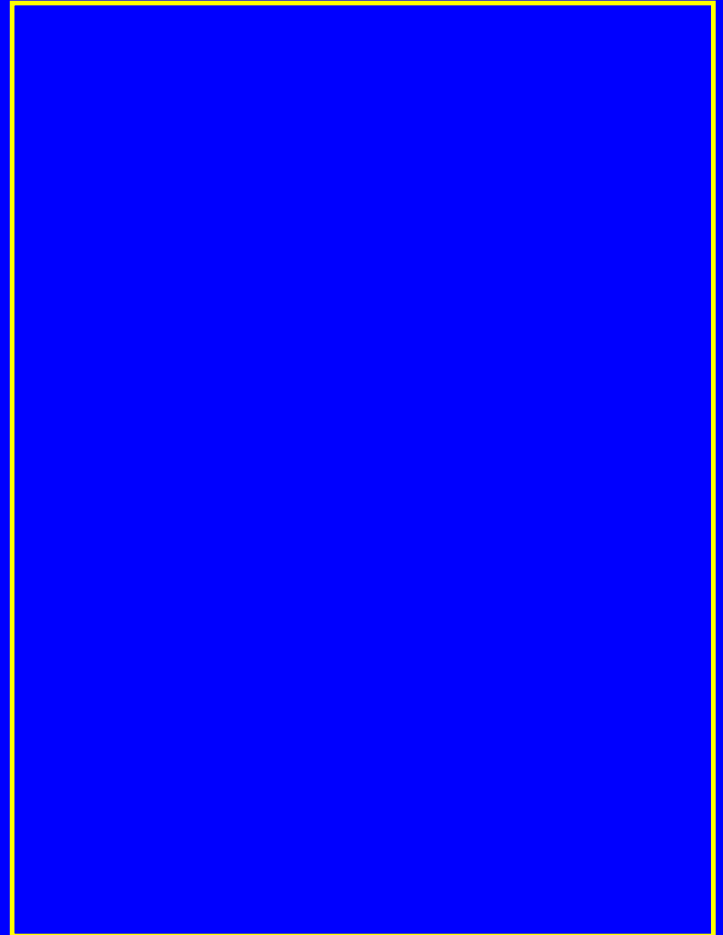
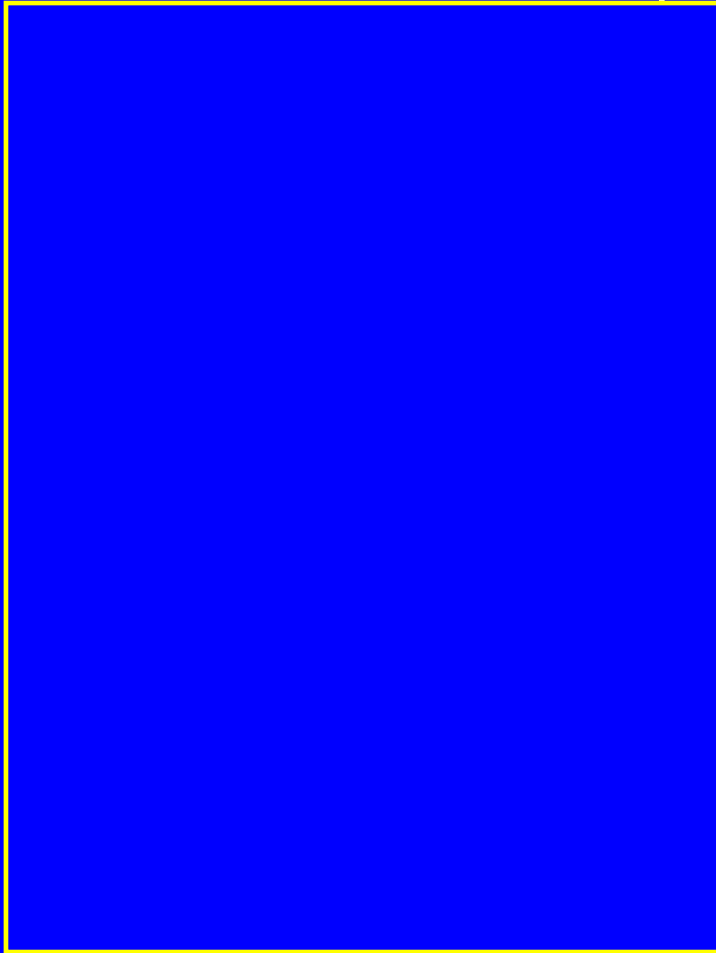
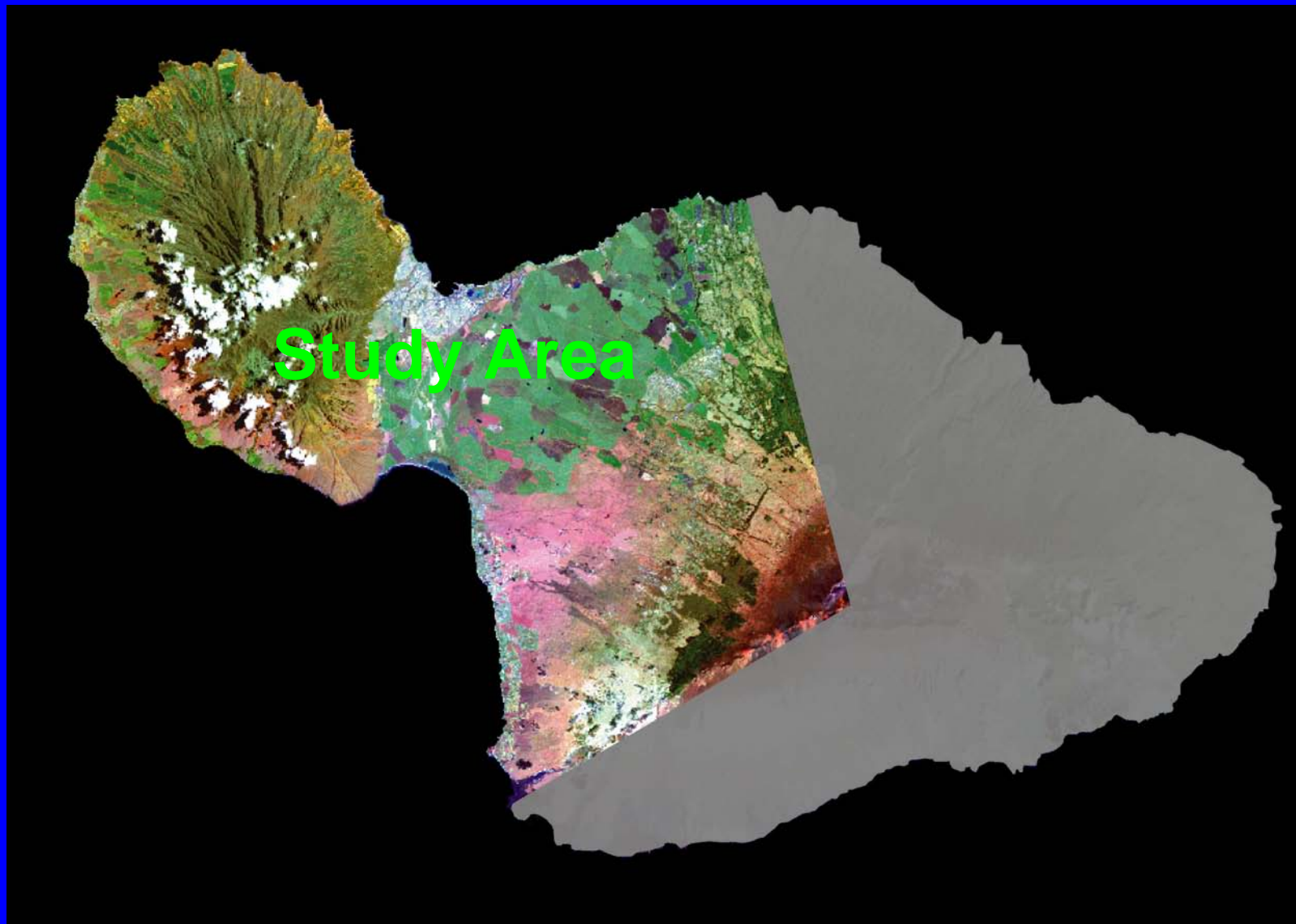


Central Maui Ground-Water Availability Study

April 21, 2005





Study Objectives

- **Improve understanding of regional flow**
- **Estimate ground-water recharge**
- **Estimate effects of selected pumping scenarios on the ground-water system**

Study Approach

- 1. Analyze existing data**
- 2. Collect climate, ground-water, and streamflow data**
- 3. Compute recharge with a water budget**
- 4. Develop numerical ground-water model**

Data collection

Need

Purpose

climate

recharge

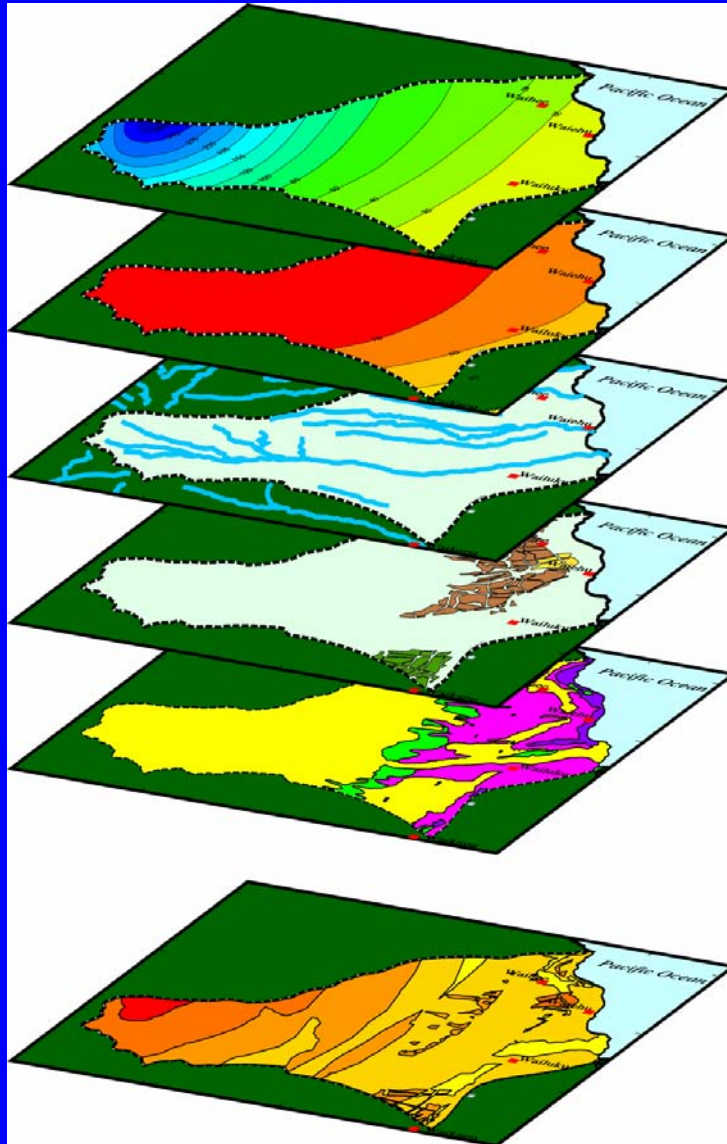
streamflow

ground-water discharge

water levels,
salinity, pumping

aquifer properties and
connection between areas

GIS Water Budget



Rainfall+Fog Drip

Evaporation

Runoff

Land cover

Soils







Recharge

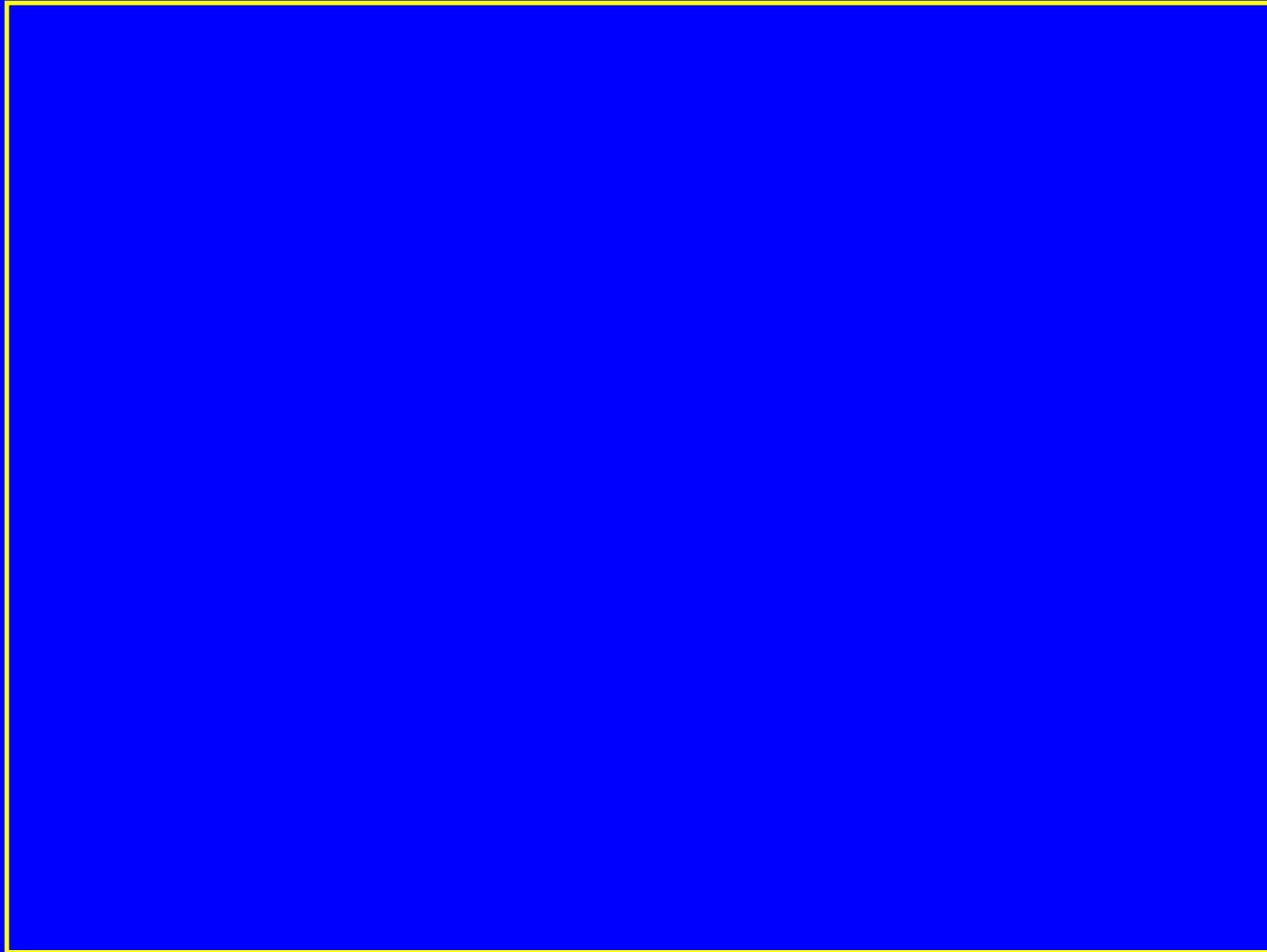
Numerical Ground-Water Model

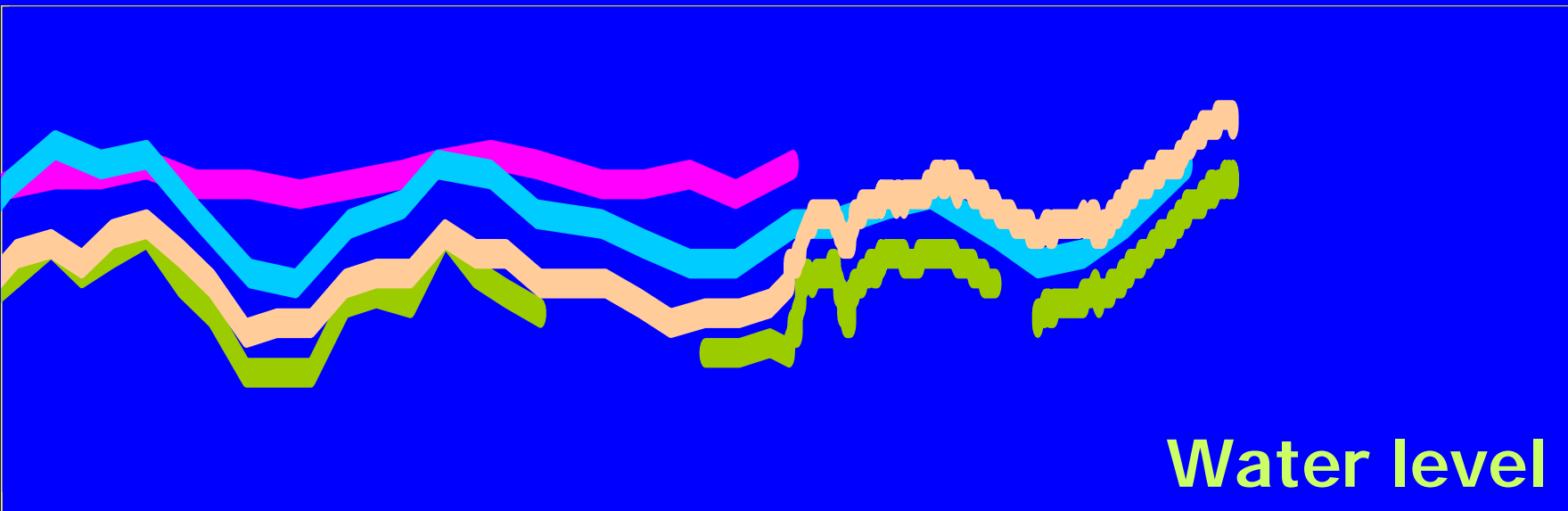
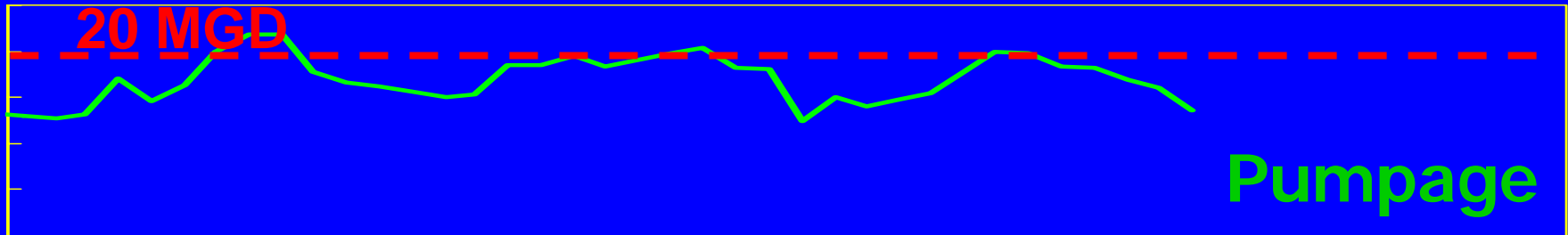
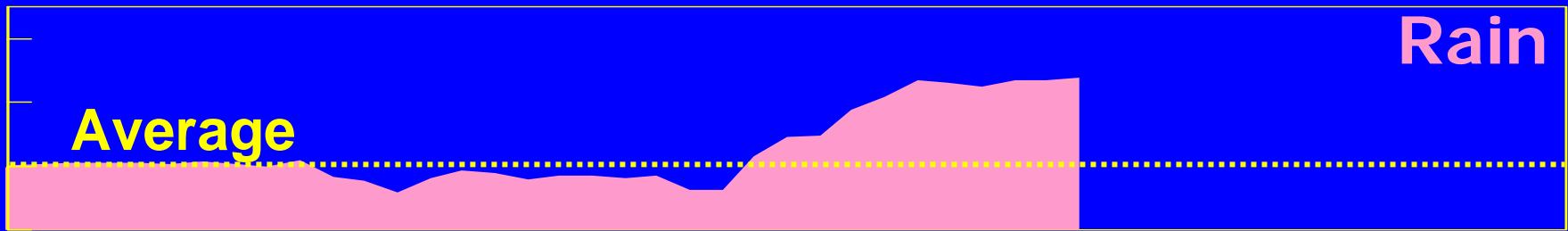
- **Mathematical representation of a ground-water system**
- **Best tool for understanding a system**
- **Predictive management approach**

Time Lines

| Task | 2003 | 2004 | 2005 | 2006 | 2007 |
|-----------------|--|--|---|---|------|
| Data review |  | | | | |
| Data collection | |  | | | |
| Water budget | | |  | | |
| Numerical model | | | |  | |

Current Status of Iao and Waihee Aquifer Areas





15

5

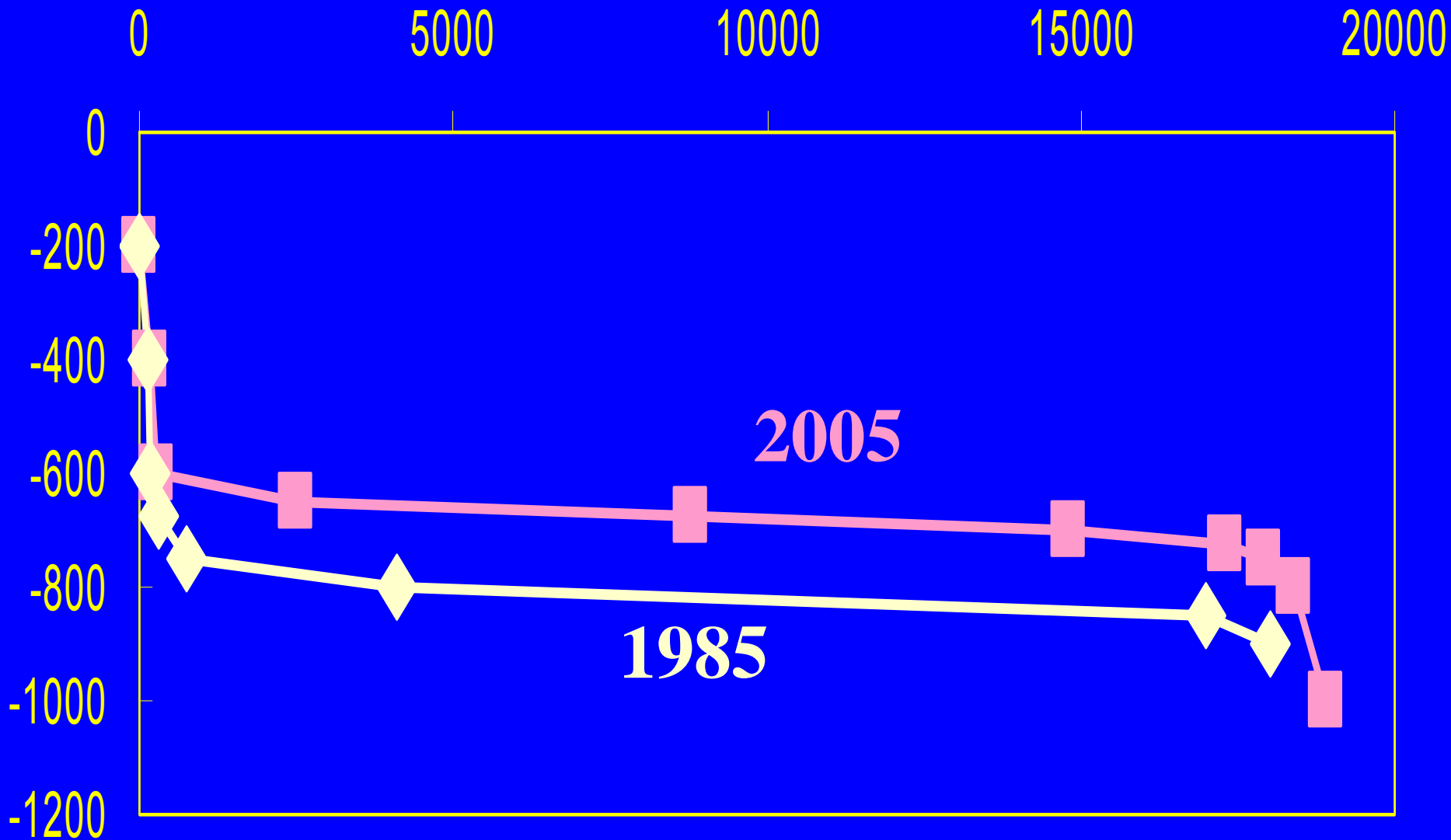
03

04

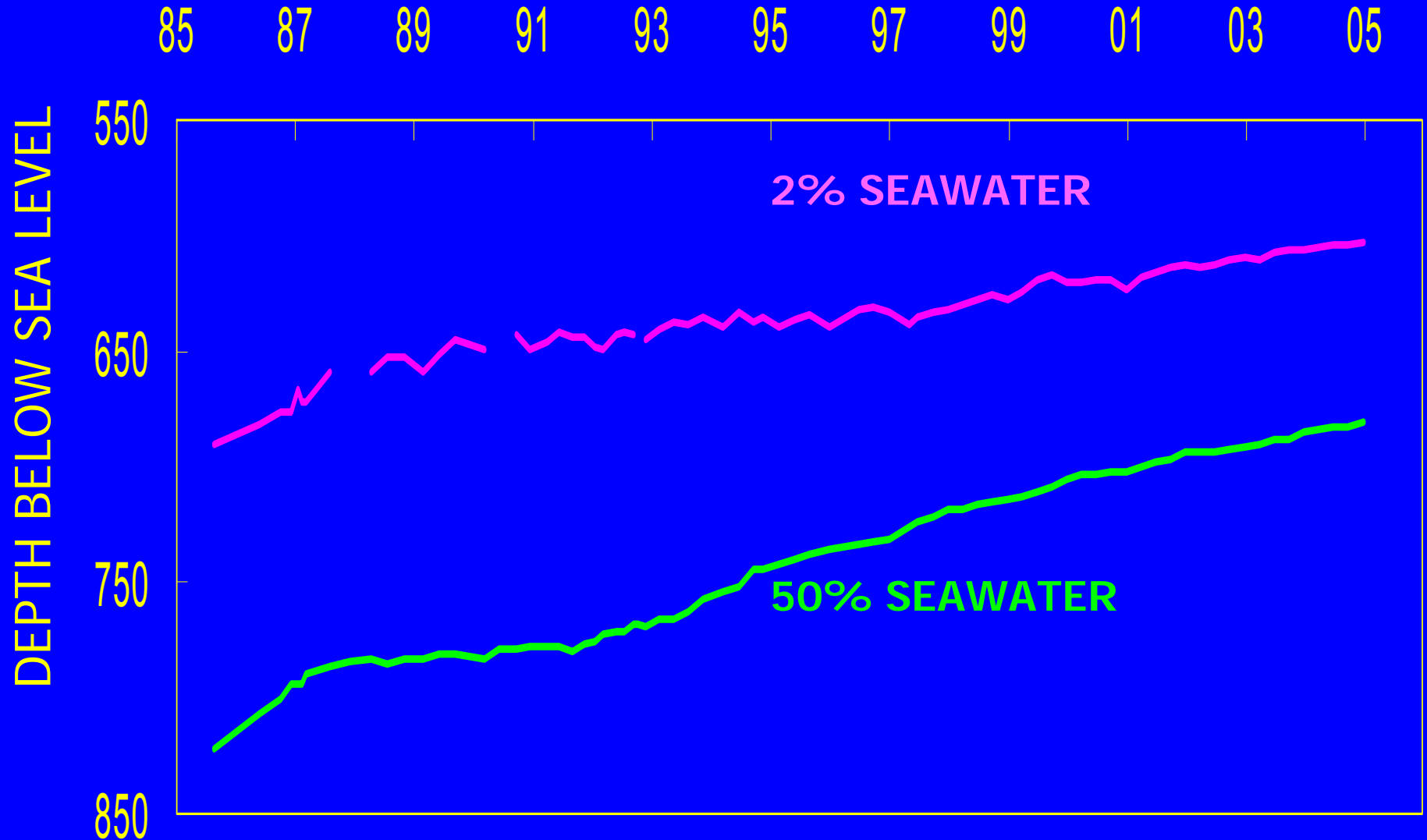
05

06

Waiehu Deep Monitor Well



Waiehu Deep Monitor Well



lao and Waihee web pages

http://hi.water.usgs.gov


Water Resources of Hawaii and the Pacific - USGS Hawaii District Home Page - Microsoft Internet Explorer

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Google hidden/lao_summary.htm Search Web 245 blocked Autofill Options



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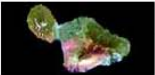
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Welcome

USGS water personnel in Hawaii and the Pacific collect data on streamflow, suspended sediment, lake and reservoir stage, ground-water level and salinity and other water-quality parameters, aquatic ecology, rainfall, and evapotranspiration, and carry out interpretive studies on the quantity and quality of surface and ground water. We work on the islands of the State of Hawaii, the Commonwealth of the Northern Mariana Islands, the Territories of Guam and American Samoa, the Federated States of Micronesia, the Republic of the Marshall Islands, and the Republic of Palau. Other USGS programs in Hawaii and the Pacific include the [Pacific Island Ecosystems Research Center](#), [Hawaiian Volcano Observatory](#), [Coastal and Marine Geology Program](#), [Coral Reefs of Hawaii and the Pacific](#), and [National Mapping](#).


Recent Features



Maui, Hawaii
[Revised well measuring-point elevations](#)




Republic of Palau
[Data-collection stations and data](#)




Guam
[Data-collection stations and data](#)

Recent Publications

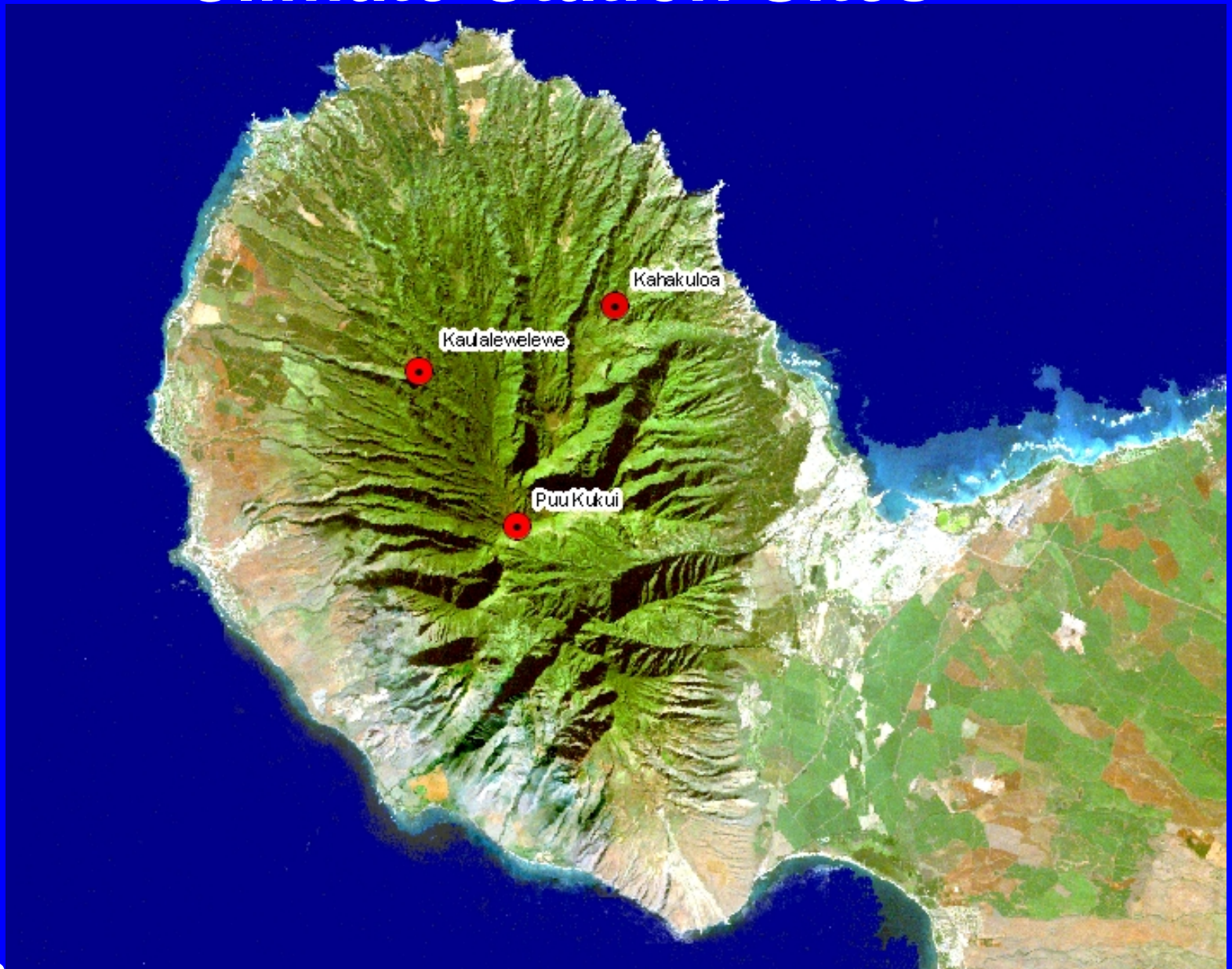


[Surface Water in Hawaii](#)



[Base Flow in Honokohau Stream](#)

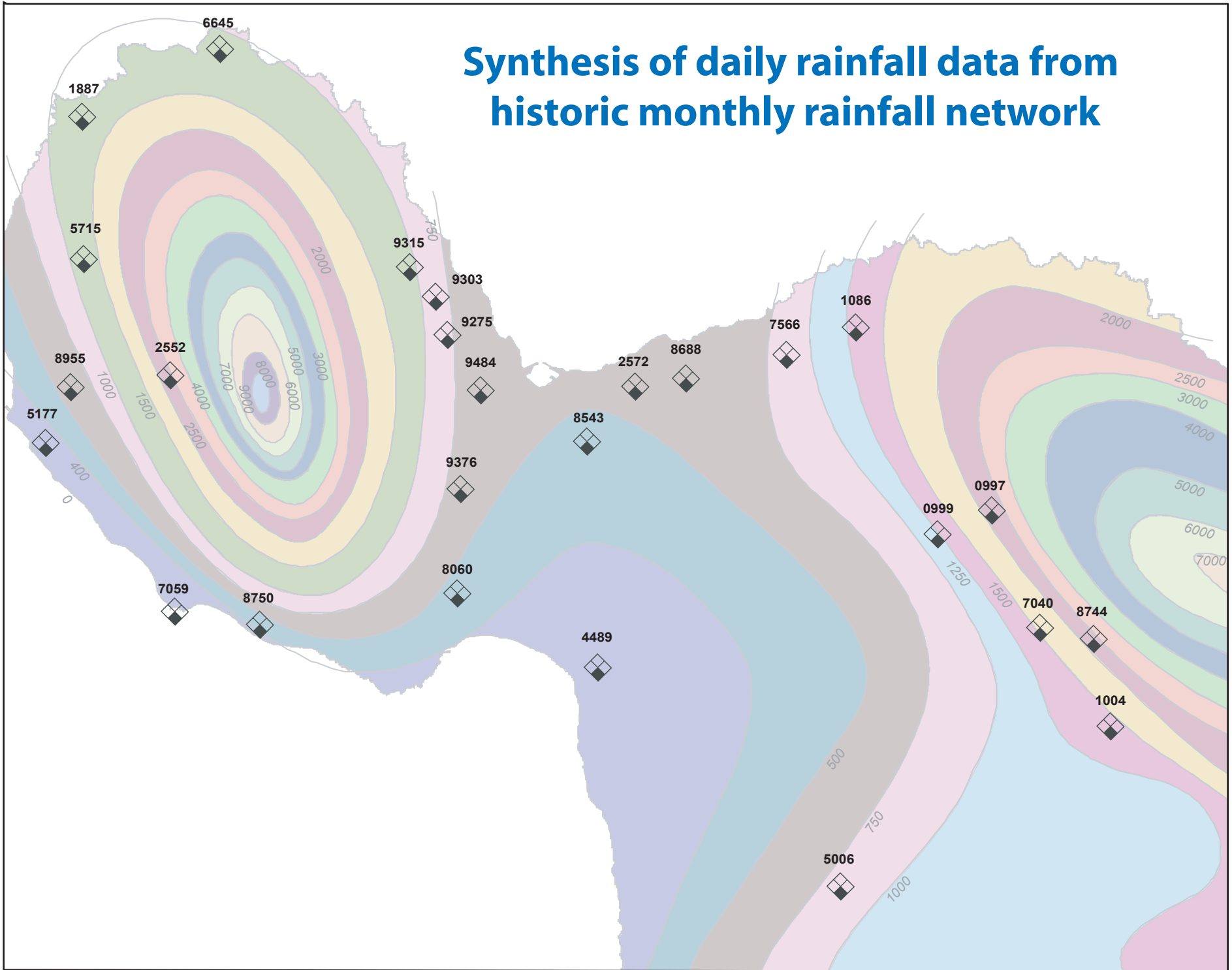
Climate-Station Sites



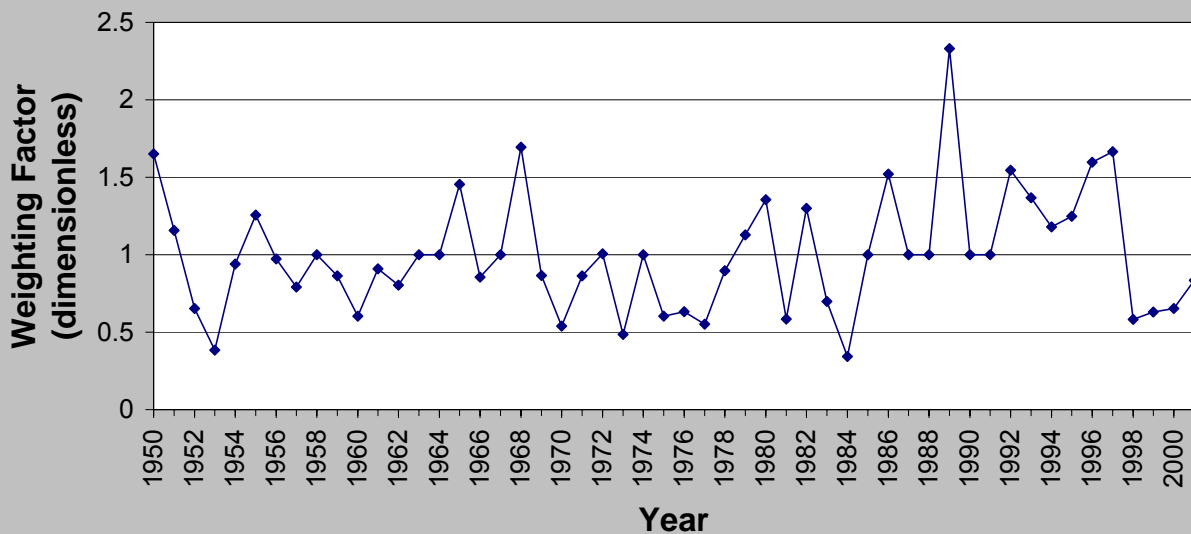
Data Collection Equipment



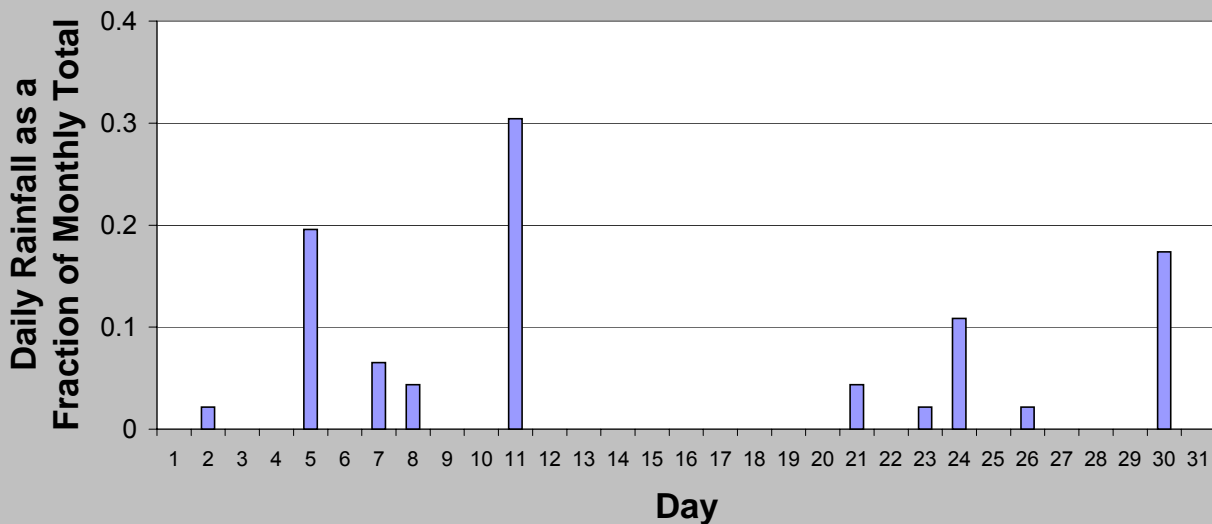
Synthesis of daily rainfall data from historic monthly rainfall network



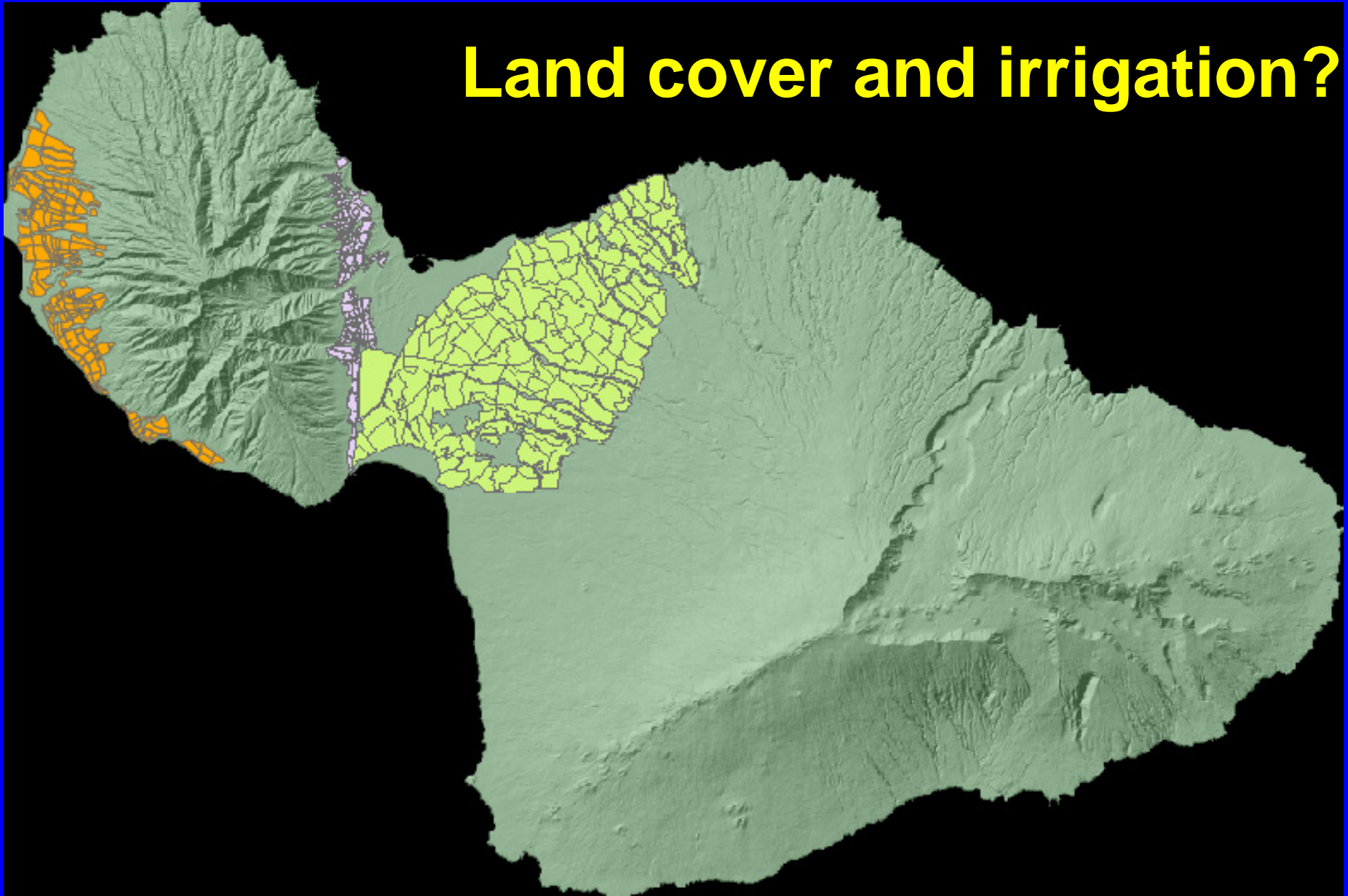
Annual Rainfall Weighting Factor--Gage #9484



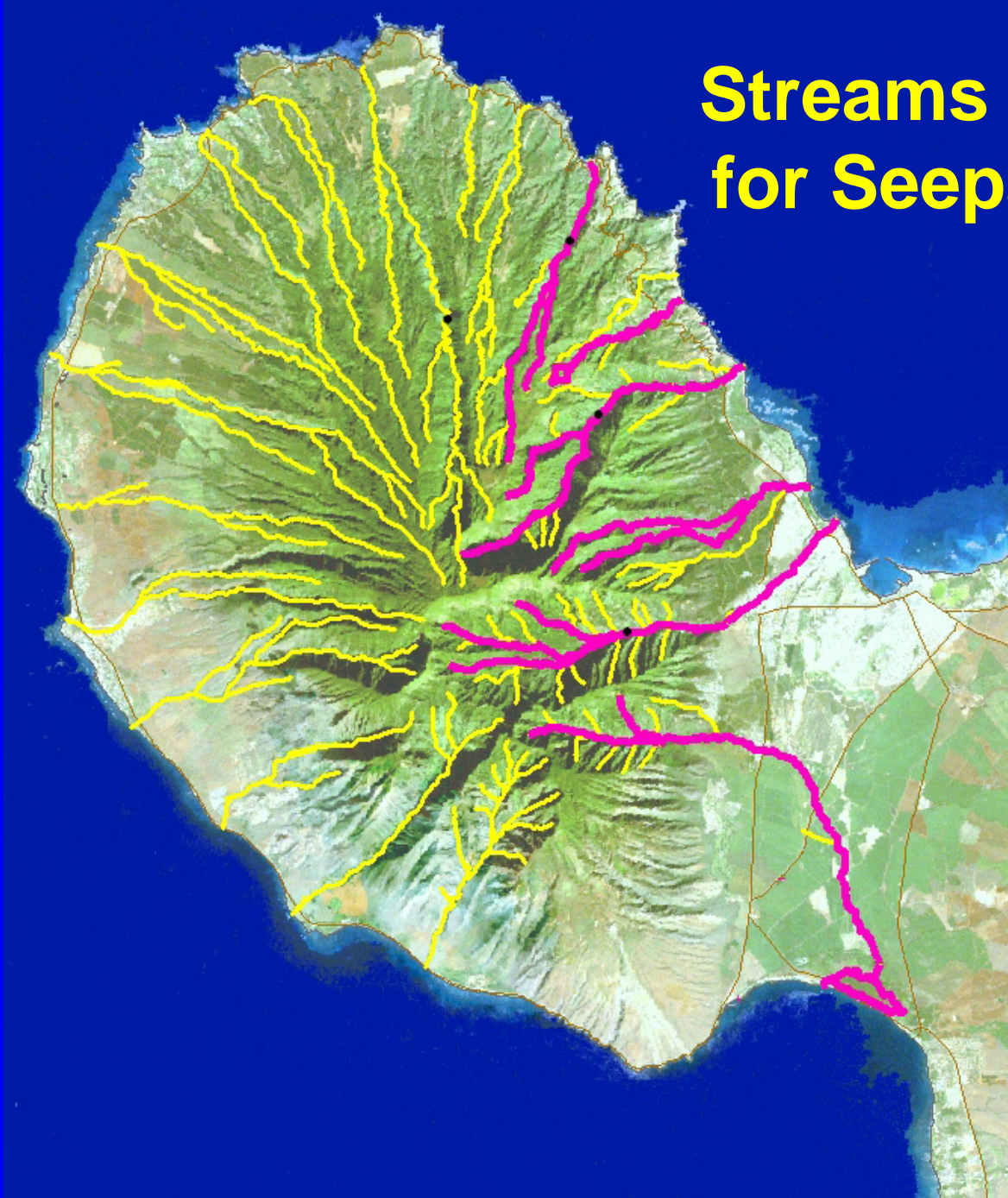
Gage #9484 Fragment Set--October 1950



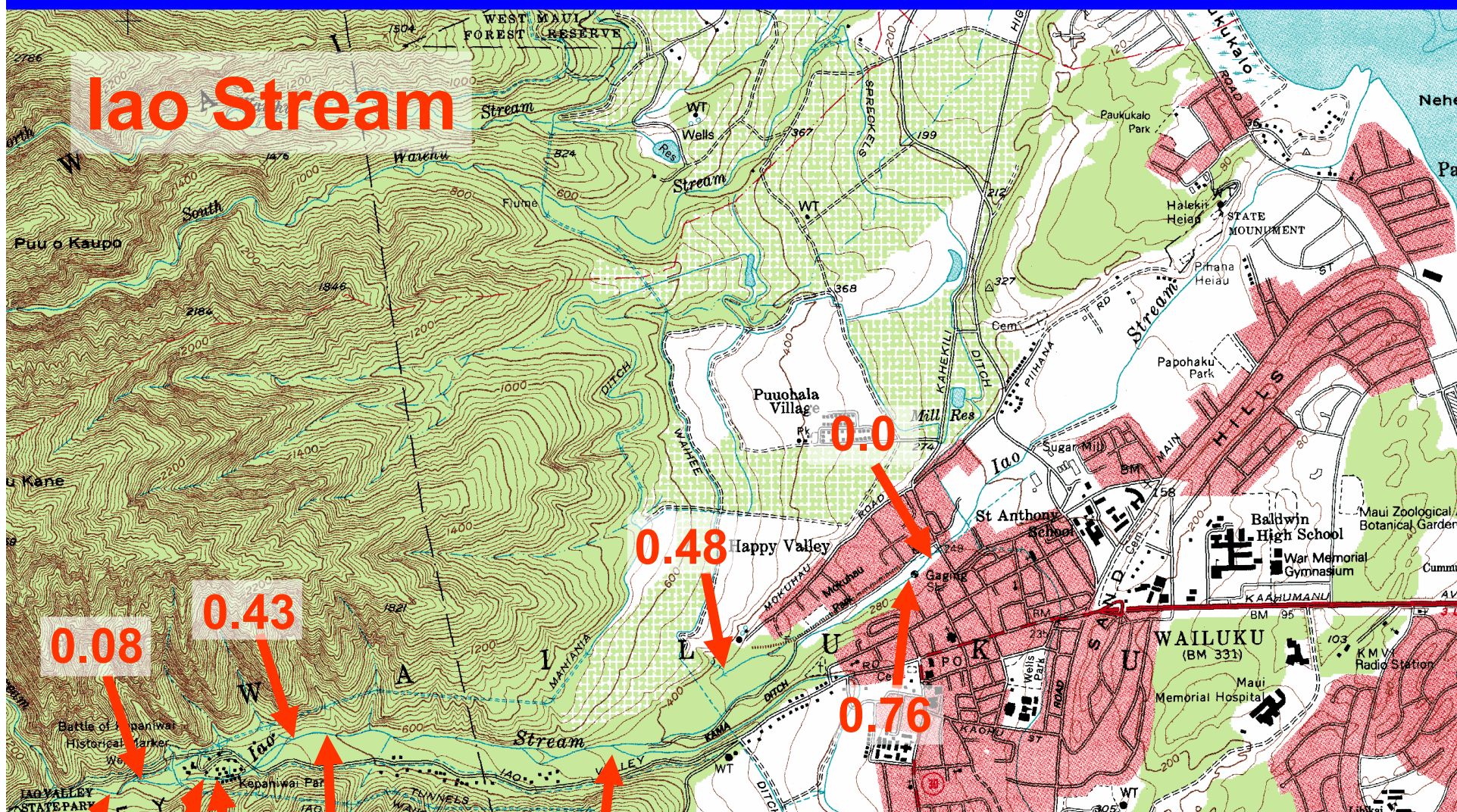
Land cover and irrigation?



Streams Proposed for Seepage Runs



Iao Stream

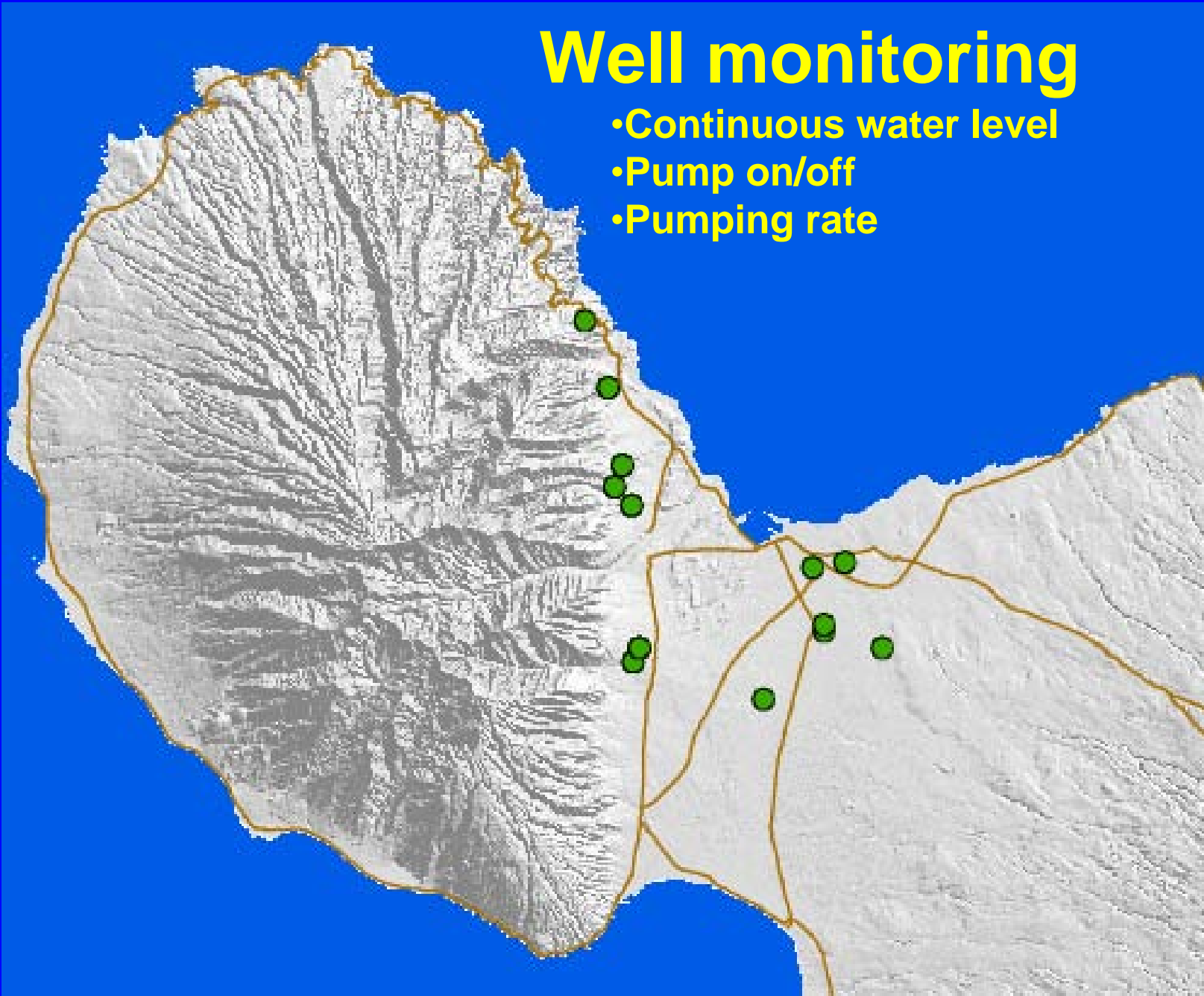


all values in ft^3/s

September 21, 2004

Well monitoring

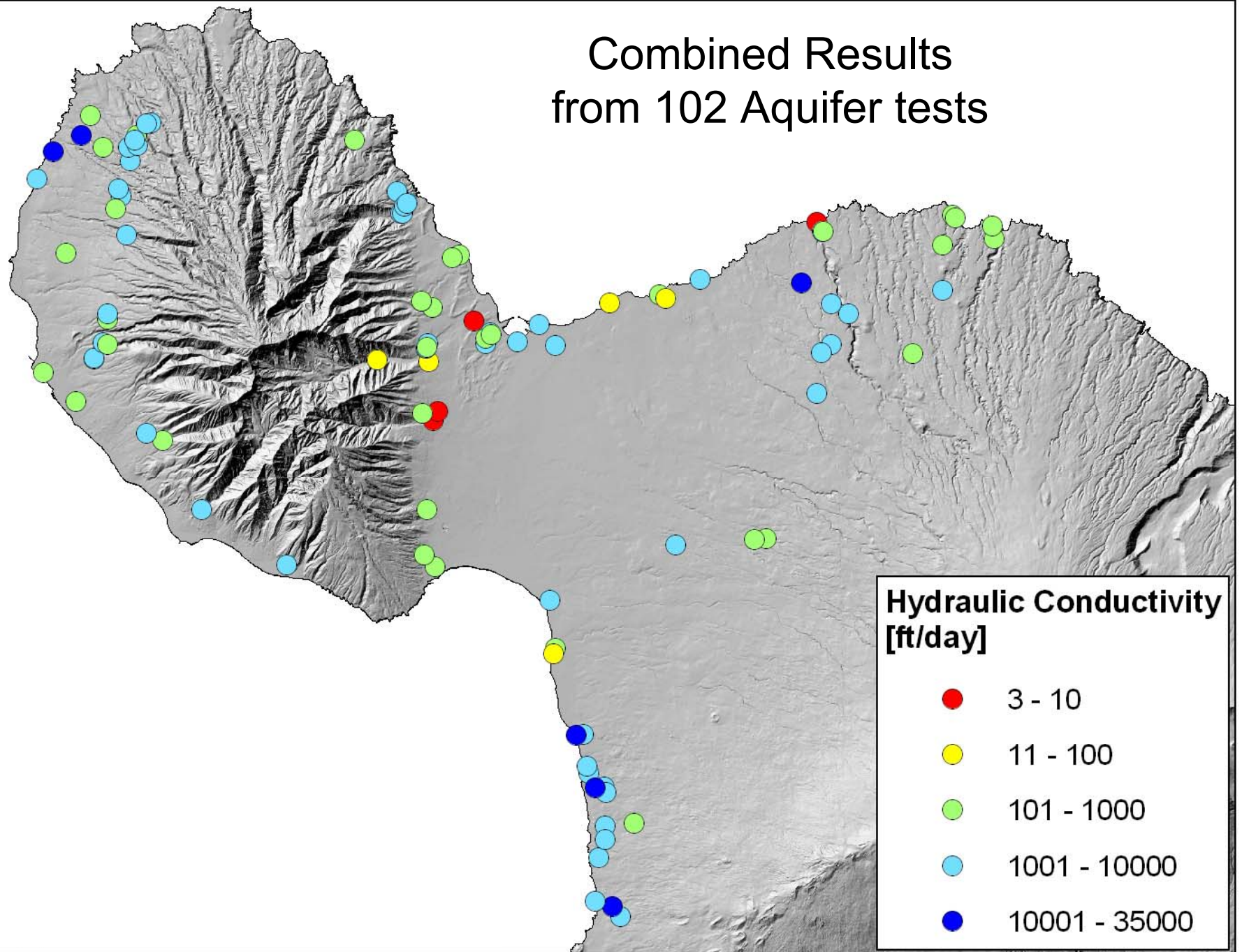
- Continuous water level
- Pump on/off
- Pumping rate



GROUND WATER

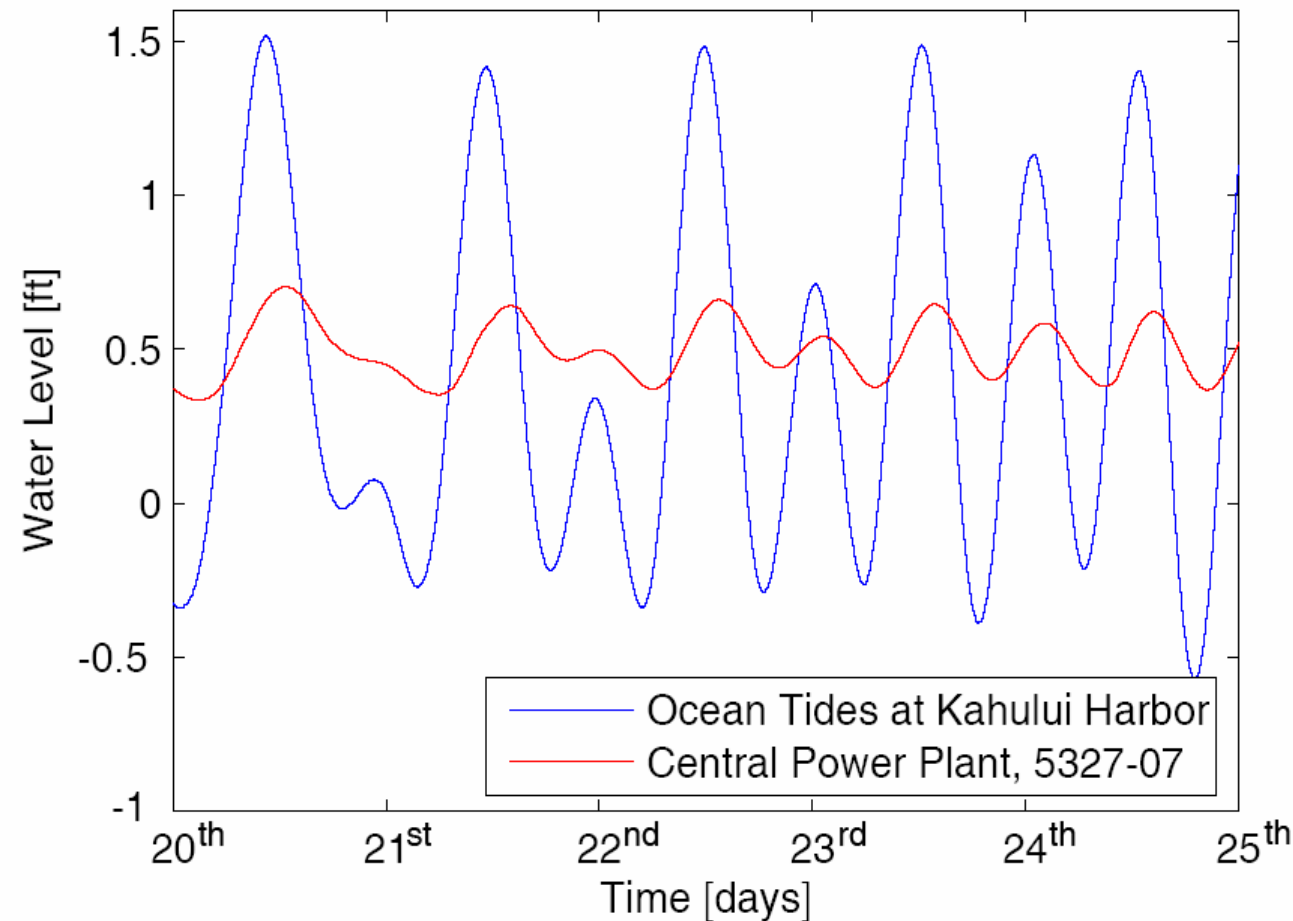
[illegible]

Combined Results from 102 Aquifer tests

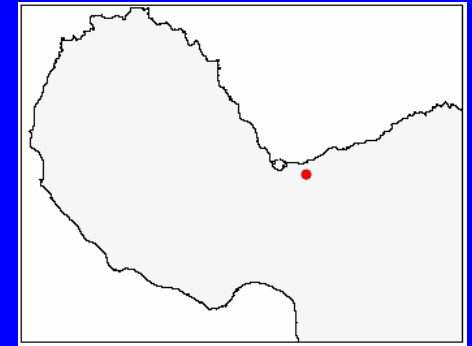


Aquifer parameters from tidal response data

OBSERVED TIDE SIGNAL, October 2004



Central Power Plant, 5327-07:



Distance from coast: 3,400 ft

Length of signal: 47 days

Phase lag: 1.7 hours

Tidal efficiency: 15.2 %

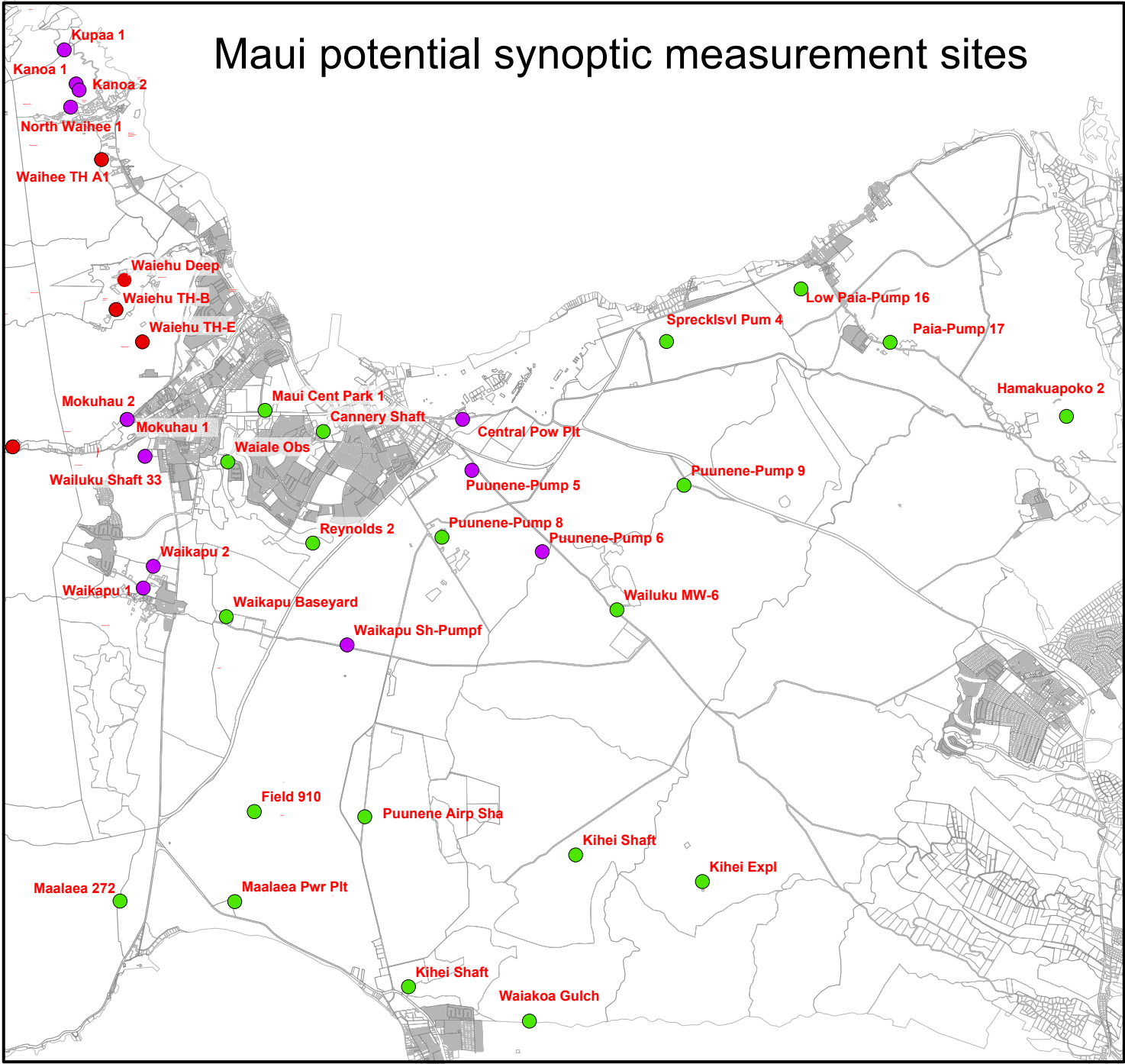
able to calculate:

Aquifer diffusivity (T/S)

Synoptic water-level survey

- Measure water level on same day at many different wells
- Provides snapshot of water-table
- Useful for estimating ground-water flow
- Calibration target for numerical model
- Last done in December, 1970
- All cooperation is welcome!

Maui potential synoptic measurement sites



Measuring point resurvey



Benchmark elevation using GPS



Water-level measurement

Plans for the next 6 months

- **GPS survey of benchmarks; May 9-11**
 - Need access from well owners
 - Can use 2 volunteers for GPS survey
- **Synoptic water-level survey; May-June**
 - Need access from well owners
 - Can use experienced volunteers and calibrated tapes for measurements
- **Seepage runs in Waiehu and Makamakaole Streams; June**
 - Need access from land owners
 - Can use experienced guides for reconnaissance

Plans for the next 6 months

- **Remove climate stations; September**
 - Any interest in continued monitoring?
- **Calculate water budget; begin July**
 - Need water-use data by end of June
 - Otherwise, we will estimate based on historic information
- **Construct numerical model; begin September**
 - Establish a modeling sub-group

Any questions?